Quantum Well Infrared Photodetectors for Low Background Applications

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Quantum Well Infrare Photodetector (QWIP) operates very similar to extrinsic bulk photocunductors. As photogenerated electron leaves the active doped quantum well region , it leaves behind a space-charge buildup which impedes another electron from entering the detector from the opposite electrode. For low-background irradiance levels, high resistivity of the active region due to thick barriers could leads to a delay in refilling space-charge buildup. This results in a lower responsitivity at high optical modulation frequencies, similar to dielectric relaxation in bulk photocundoctors. In order to overcome this problem, we have designed QWIP structure separating active quantum well region and blocking barrier. The quantum wells in the structure are separated by thin barriers creating a miniband due to large overlap of sublevel wavefunctions. Space-charge buldup quickly refilled by electrons via sequential resonant tunneling from the contact layer . Similar to block impurity band detectors, a thick impurity free blocking barrier is placed between the active region and collector contact to suppress dark current of the device.

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